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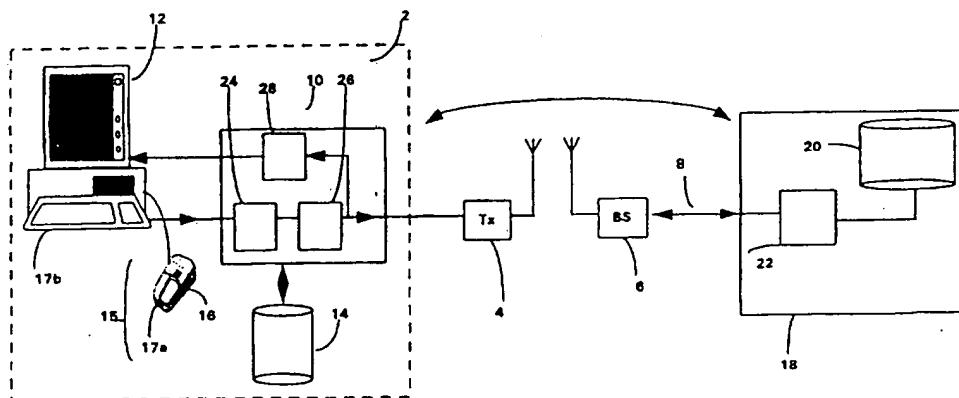
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(54) Title: COMMUNICATION METHOD AND SYSTEM BETWEEN HOST AND REMOTE WORKSTATION



## (57) Abstract

A method of communication over a telecommunications network between a central computer system and a remote terminal. The remote terminal includes storage means for local storage of data. To reduce the bandwidth requirement for a connection between the remote terminal and the central computer system, the central computer system where possible, transmits a command for the remote terminal to display its locally stored data rather than transmit the data itself. Additionally, the remote terminal only provides information relating to the position of screen pointers when a command is entered for example by clicking with a mouse. In this way the bandwidth requirement is further reduced since it is not necessary to constantly update the central computer system as to the position of the pointer.

## COMMUNICATION METHOD AND SYSTEM BETWEEN HOST AND REMOTE WORKSTATION

The present invention relates to a method of communication over a telecommunications network and in particular to such communication between a central computer system and a remote terminal.

There is presently much interest in the idea of "teleworking" i.e. being able to use computer facilities remotely from a central computing facility (typically from a location at home), and in being able to access such facilities whilst on the move.

Software, commonly referred to as "remote access software", has been developed which permits a user to control an application program running on a remote computer from a local computer via a computer modem connection. However, since such modem connections have a relatively low maximum bandwidth (i.e. transmissible volume of data per unit of time) such software often operates impractically slowly. This problem is particularly apparent when the application program is executing in a GUI (graphical user interface) environment where large volumes of data relating to the graphical displays must be transferred.

According to the present invention, there is provided a method of communication over a telecommunications network between a central computer system and a remote computer terminal, the terminal including storage means, the method comprising:

- loading the storage means with data related to an application program prior to execution of the application program;
- establishing a connection between the terminal and the central computer system via the network;
- transmitting a command from the central computer system via the network to the terminal to cause the terminal to read specified data from the storage means;
- and arranging the command and the specified data such that less transmission bandwidth is required over the network to transmit the command than would be required to transmit the data.

According to a second aspect of the invention there is provided a computing means for communicating with a remote computer terminal over a telecommunications network, the computing means having processing means

Typically the storage means will be non-volatile storage means such as a hard disk drive, programmable ROM (read-only memory) or battery-backed RAM (random access memory).

The present invention can yield considerable data compression, and so is particularly suited for use over a mobile telephone connection such as that provided by a digital mobile telephone system. Currently the maximum bandwidth of such connections is 9.6kbit/s and this has been found impractical for use with traditional remote-access software, but it would be adequate for the method of the present invention. Moreover, data transmission services provided over GSM (Global System for Mobile communications) networks will shortly be available on a "pay-per-packet" basis so that a user pays according to the amount of data being transmitted, regardless of the length of time the connection is maintained. Thus the method preferably includes incorporating a connection over a digital mobile telephone network into the connection established between the terminal and the central computer system.

Preferably the commands are transmitted under the control of an application program executing on the central computer system. Thus it will be appreciated that the remote terminal may simply comprise the display means, a user input device, the storage means, and any necessary hardware to interconnect these components and to communicate with the central computer system. Since the application program is executing on the central computer system and not on the remote terminal, very little processing power is required in the terminal. In particular, only the results of the processing need be returned to the user. Thus the terminal may be cheap and lightweight, and may require less power consumption than a typical present-day notebook computer. Furthermore, upgrades in necessary processing power may be performed centrally and need not require an upgraded terminal, except insofar as new or modified data may be required to be loaded in the storage means to support such new applications.

Commands may be entered at the remote terminal using any conventional input device such as a keyboard. In applications in which the remote terminal includes a pointing device such as a "mouse" or cursor keys, and the display means is arranged to display a pointer (or "cursor") movable under control of the pointing device, the method advantageously includes the transmission of information related to the position of the pointer to the central computer system

the central computer, for example by comparing a version number stored at the local terminal with one stored in the central computer.

Preferably the initial data is loaded into the storage means by downloading data from the central computer system. This may be a service provided by the telecommunications network operator (or a third party) to allow terminal users to update the information stored in their terminals to take advantage of different or updated application programs available on the central computer system. Further data can be downloaded later, either as required to meet particular commands from the user terminal, or using spare capacity in the communications link, in anticipation of it being required subsequently.

Occasionally, display of images on the terminal may be initiated by the user. This will typically be the case when the terminal is first trying to access the central computer system and it is necessary to display some sort of welcome or menu screen. When this happens, information relating to the image displayed is provided to the central computer system. This enables the central computer system to synchronise with the status of the remote terminal so that it can correctly interpret any commands issued by the user via the terminal.

The system of the invention can be run using any suitable operating system on the central computer, for example the Solaris 2.5 UNIX platform or the Microsoft "Windows NT 4.0" operating system, with the user system operating under a compatible system such as Microsoft "Windows 95". Dial-up server facilities are already available on these systems, allowing the user to specify what protocol to operate under and how it should be configured. One suitable protocol is the Hypertext Transfer Protocol (HTTP). The invention can be implemented by adding to these existing systems by carrying out a small amount of processing at the user terminal, allowing a reduction in the amount of data to be transferred. In particular, by duplicating certain frequently-used data, such as applications screens, only such information need be exchanged as is necessary to modify the data, such that both copies of the data remain in agreement. In this way, the system can be arranged to appear to the user as if it is running the application on the central computer in the conventional manner, but very much less data transfer is required between the user's terminal and the central computer.

image command data received from the computer 18 is decompressed by a decompression processor 28 for display by the display means 12.

Prior to use, the storage means 14 of the user terminal 2 is loaded with some application programmes, to allow it to co-operate with the computer system 18.

In use, an application is called up in the computer system 18 by transmission of a command from the terminal 2 via the transceiver 4, base station 6, and network 8. Typically the application will be established after a user has responded to information presented on the display means 12 in the form of a "welcome screen". The welcome screen is stored locally in the storage means 14 and includes a menu of application programs which the user may choose to execute. Preferably the welcome screen should emulate the screen that a user of the conventional system, i.e. in direct contact with the central computer, would see when first switching on. The user's selection is made using the input means 15 in conjunction with the welcome screen displayed on the display means 12. When the user selects an application program, perhaps by clicking on an item on the welcome screen using the mouse 17a, or by making a menu selection using cursor keys and the keyboard 17b, a telecommunications connection is established to the central computer system 18, and then a command is sent to that computer system to cause the processing means 22 to initiate execution of the chosen application program.

As an initial step, the central computer system 18 has to identify the user terminal 2 with which the connection is being established, preferably by using the CGI mechanisms. This allows the central computer system 18 to configure its operation according to the user terminal 2, in particular the operating system it is operating under, the information currently stored in the storage means 14, its communications capabilities (in particular the maximum bit-rate it can receive) and any user-specific authorisations (e.g. read-only) for data stored by the central computer system 18.

The user may be required to confirm his identity manually, e.g. by entering a password.

As the application is initialised on the central computer system 18, the terminal 2 is instructed by the central computer system to retrieve an appropriate screen from the local storage means 14 and display it on the display means 12.

can correctly interpret any subsequent commands received from the remote terminal 2.

Figure 2 shows the computer terminal 2 and central computer system 18 in more detail, including certain of the functional elements necessary for the updating of the image. It will be appreciated that these functional elements will be embodied in software configured to run on the computer terminal 2 and central computer system 18.

The input device 15 (illustrated as a mouse) includes a position transponder 16 and a command input device, such as the "click" button 17a of the mouse. As is conventional, the movement of the mouse is tracked by transducers responsive to the motion of the mouse over a surface, which is converted by a vector conversion unit 30 into movement vectors. These in turn are converted into position co-ordinates in a position determination unit 32. The output from the position determination unit 32 is fed to an image generation unit 34, which has the functionality necessary for generating an image of a cursor 44 at the appropriate location on the display device 12. The image generation device 34 has other inputs, as will be described later.

When the user carries out an operation indicating that a command is to be carried out (e.g. by pressing the click button 17a, or pressing the return key on a keyboard), this is detected by a "send" function 36, which retrieves the current position of the cursor as determined by the position determination function 32, and transmits this position, by way of the communications link 4, 6, to the central computer system 18. In the central computer system 18, a position update function 38 responds to the position information to identify the position of the cursor, and updates a stored version of the image represented on the display device 12, which is stored in the central computer in a store 46. The action of transmitting the update information by means of the send function 36 acts to modify the image stored in the store 46 to match that displayed on the display device 12. Thus, the mouse's motion is tracked in real time locally, but is discontinuously tracked at the central computer.

The modified image recorded by the position update function 38 is fed to the processing unit 22 which acts according to the input represented by the modified image. For example, "clicking" (using the button 17a) when the cursor 44 is in an area of the screen in which a specified icon is displayed, causes

Figure 3 illustrates in flowchart form one method by which data (either image data or other data files) can be accessed from the stores 14, 20. When a request is made by the user to access a data file (step 101), for instance by transmitting a command, the central computer system 18 would, in general, be required to retrieve a copy of the file from its own storage means 20 and transmit the copy over the communications link 4, 6 to the terminal 2 (step 113). However, the central computer system 18, when it receives the command, first evaluates it (steps 102, 105, 106) to determine whether the remote terminal needs to be sent the requested information, or simply a reference to a document already held by the remote terminal 2. In order to minimise the amount of data transfer required, any data which is transferred is also stored in the terminal's own storage means 14, (step 116) and the fact of this storage is recorded as a 'flag' in the central computer storage means 20 (step 114). If, in a subsequent session, the user requires access to the same file, the central computer system 18 identifies from the presence of the 'flag' in the storage means that the user terminal already has this data (step 105), thereby avoiding the unnecessary re-transmission of the same data.

Amendments made by the user to the data in such a file are performed on both copies whilst the user is on-line (step 117). If other users have write-access to the same data, amendments made to the copy in the central storage means 20 by such other users whilst the first user is off-line cause the 'flag' to be deleted, to indicate that the first user no longer has the current version, and the amended version will require downloading should the first user require the datafile in a future session. If a substantial part of the document is unchanged, a different flag may be placed on the data, to instruct the central computer system 18 to transmit only amendment instructions to the user terminal 2 (step 108).

The 'flags' in the central computers' data store are, of course, user-specific, as different users will have accessed the same data at different times and therefore will have different versions stored locally.

The capacity of the data store 14 in the terminal 2 may be limited, and so stored data may require to be periodically over-written by the new data. In such a case, the 'flag' stored in the central computer 18 will be incorrect. When over-writing takes place, the remote terminal 2 may transmit a signal to the central computer 18 instructing it to remove the 'flag'. Alternatively, or as a safeguard, if



data already stored in the data store 14 of the terminal 2. If the update flag is set then the central computer system 18 transmits an instruction to first modify the current version to reflect the changes which have been made since the user last accessed the data (step 108), and then to use this modified version.

5 In either of the two cases where a flag has indicated the presence in the user terminal of a version of the required data, the user terminal 2 retrieves the version of the data currently stored in the store 14 (step 109a, 109b). The user terminal 2 next checks (step 110a, 110b) whether the version present in the store 14 is the current version, by following the instructions transmitted from the central  
10 computer in steps 107/108.

If the data is not present (e.g. because it has been overwritten to make way for more recent data, or because it has been corrupted), then a "not found" signal is transmitted (step 111) to the central computer 18. On receiving such a signal (step 112) the central computer 18 retrieves the relevant data and transmits  
15 it to the user terminal 2 in the same way if there had been no flag on the data for that user (step 113). On transmitting the data to the user the user flag is amended (step 114) to identify that the user now has the current version of the data.

If the user terminal 2 successfully retrieves the data from the store (steps 110a, 110b) then the data is updated (step 115) using the update instructions  
20 transmitted from the central computer 18 (step 108), if any. The updated version is stored in the store 14 (step 116), overwriting the previous version that was stored there.

The version retrieved from the store (step 109a) or as newly retrieved (step 113), or updated (step 115) can then be used by the remote terminal 2 (step  
25 117). As has been described above, any changes which are made to data files are transmitted back to the central computer 18 so that amendments can be stored in the corresponding data file 20 at the central computer (step 118). If any such amendments are made, the flags corresponding to other users and relating to that data file are amended to indicate that they no longer have the current version.

30 In the alternative process shown in Figure 4, in which steps corresponding to those in Figure 3 have the same reference numerals, the central computer 18 responds to the presence of a flag indicating whether the user terminal 2 has already got the data (step 105). (In this version, the flag may be retrieved from the

CLAIMS

1. A method of communication over a telecommunications network (4, 6, 8) between a central computer system (18) and a remote computer terminal (2), the  
5 terminal including storage means (14), the method comprising:  
loading the storage means (14) with data related to an application program prior to execution of the application program;  
establishing a connection between the terminal (2) and the central computer system (18) via the network (4, 6, 8);  
10 transmitting a command from the central computer system (18) via the network (4, 6, 8) to the terminal (2) to cause the terminal (2) to read specified data from the storage means (14);  
and arranging the command and the specified data such that less transmission bandwidth is required over the network (4, 6, 8) to transmit the command  
15 than would be required to transmit the data.
2. A method according to claim 1, including transmitting the command under the control of an application program executing on the central computer system (18).  
20
3. A method according to claim 1 or claim 2, wherein the connection established between the terminal and the central computer system incorporates a connection over a digital mobile telephone network.
- 25 4. A method according to claim 1, 2 or 3, wherein the application program and commands control the generation of an image on a display means (12).
5. A method according to claim 4, wherein the terminal includes a pointing device (16), and the display means (12) is arranged to display a pointer (44)  
30 movable under control of the pointing device (16), and the method includes transmitting information related to the position of the pointer (44) to the central computer system (18) only when a user of the terminal (2) issues a command for execution by the central computer system (18).

10. A method according to claim 9, wherein if the data stored in the central computer system ceases to correspond with the duplicate version stored in the remote terminal, the record in the central computer system is amended; and if the remote terminal (2) requests the data subsequently, amending the duplicate  
5 version of the data stored in the remote terminal (2) to again correspond with the data stored in the central computer system (18).

11. A method according to any preceding claim, wherein capacity in the connection (4, 6, 8) established between the central computer system (18) and the  
10 remote terminal (2) not required for the transmission of commands to the remote terminal (2) is used to transmit further data relating to application programs to the remote terminal (2) for storage in the storage means (14) for subsequent use by the remote terminal (2).

12. A computing means (18) for communicating with a remote computer  
15 terminal (2) over a telecommunications network (4, 6, 8), the computing means having processing means (22) arranged to execute an application program under the control of a remote terminal (2), and responsive to commands from the remote terminal (2) to transmit commands to the remote terminal (2) to cause accessing  
20 by the remote terminal (2) of data stored in the remote terminal (2).

13. A computing means (18) according to claim 12, comprising storage means (20) for storing application programs and commands, and the processing means (22) being arranged to retrieve application programs from the storage means (20)  
25 under the control of a remote terminal, and to retrieve commands from the storage means (20) in response to commands from the remote terminal in accordance with the application program so retrieved, and to transmit said commands to the remote terminal.

14. A computing means (18) according to claim 12 or 13, wherein the storage  
30 means (20) comprises means for storing data, the processing means (22) being arranged to transmit said data to a remote terminal on request, and the storage means (20) having record means activatable to record that said data has been transmitted, the processing means having means to identify requests for such

21. A computer terminal according to claim 20, including an input means (15) comprising a position transducer (16) and an input command means (17a, 17b) for controlling the display means (12) to display the position of a pointer (44) under the control of the position transducer (16), and wherein the processing means (10) is arranged to transmit the position of the pointer (44) to the remote computer (18) in response to a predetermined input from the input command means (17a, 17b).

22. A computer terminal according to claim 17, 18, 19, 20 or 21 wherein the processing means (10) includes buffer means (24) for storing commands received from the input command means (17), and data compression means (26) for converting the stored data into a compressed form for transmission by the transceiver (4).

23. A computer terminal according to claim 17, 18, 19, 20, 21 or 22 wherein the processing means (10) includes data compression means (28) for converting data received by the transceiver (4) in compressed form into a form suitable for display by a display means (12).

24. A computer terminal according to any of claims 17 to 23 wherein the processing means (10) further comprises means for receiving data from a remote computer means (18), and for storing said data in the program storage means (14) for subsequent retrieval.

25. A computer terminal according to any of claims 17 to 24 including means for requesting data from the central computer (18), means for receiving said data, means for creating and storing a duplicate copy of the said data, and means for retrieving said duplicate copy in response to a signal received from the central computer (18).

26. A computer terminal according to claim 25, including means to amend the duplicate copy in response to data received from the central computer (18).

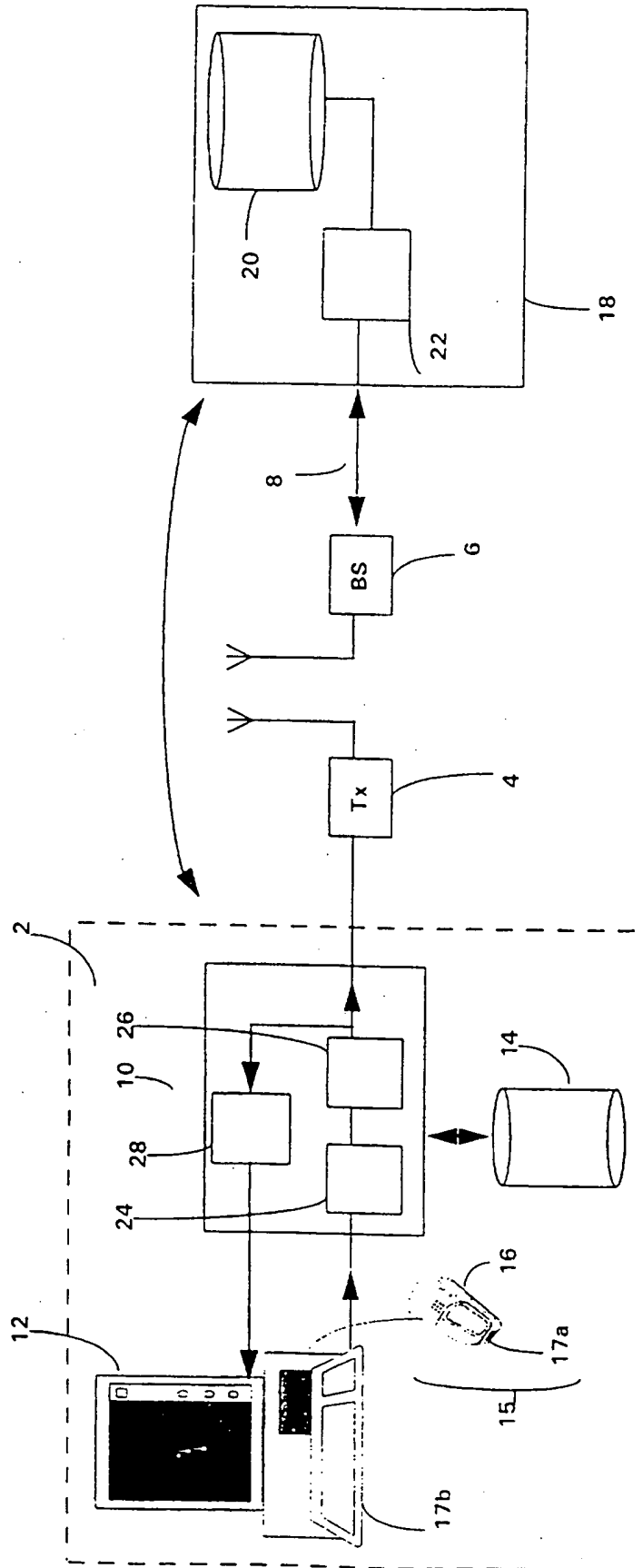
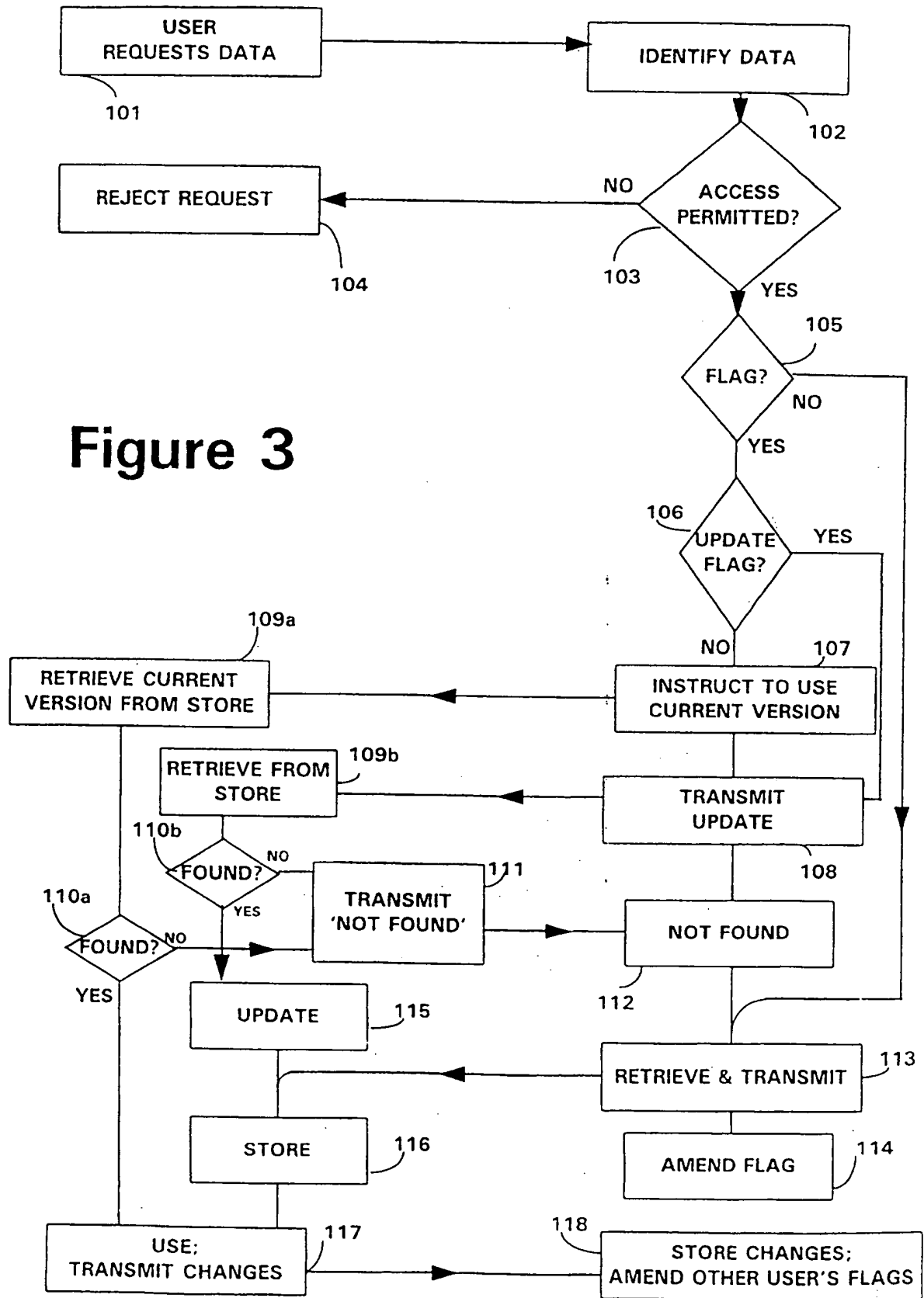


Figure 1



## INTERNATIONAL SEARCH REPORT

Inter. Application No.

PCT/GB 97/00713

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 347 632 A (R.FILEPP ET AL) 13 September 1994 see column 4, line 9 - column 6, line 38 see column 7, line 26 - line 46 see column 8, line 28 - line 61 see column 84, line 45 - column 88, line 68	1,2,4,8
Y	---	5,7,9
X	EP 0 666 681 A (TRANSACTION TECHNOLOGY, INC.) 9 August 1995	12,13, 17-20
Y	see claim 1 see column 38, line 19 - line 47 ---	21-26
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

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